REMARKS

Claim 1 has been amended to include the limitations of claim 58 and claim 58 has been canceled. Specifically, claim 1 has been amended to recite that the aggregate of nanofibers of the present invention, having a morphology of a filament-yarn and/or a morphology of a spun yarn, has an orientation that extends in one dimension over a definite length. The aggregate of nanofibers according to the present invention, because it has an orientation that extends in one dimension over a definite length, can be made into various fibrous materials (page 15, lines 6-11, of the present specification).

In the Action of June 11, 2009, the Office is rejecting claims 1, 7, 11-12, 16-19, 53 and 58-59 under 35 U.S.C. § 102(b) as being anticipated by Mirle et al., US 2002/0035354 ("Mirle").

Applicants submit that Mirle does not support a case of anticipation under 35 U.S.C. § 102. Mirle does not disclose, either explicitly or inherently, an aggregate of nanofibers having an orientation that extends in one dimension over a definite length.

The Office describes Mirle as disclosing a spunbonded web that would comprise fibers having a morphology of a spun yarn and that would have an orientation that extends in one dimension over a

definite length or at least several meters. The Office is not correct.

As is well known to a person of ordinary skill in the art, fibers in a spunbonded nonwoven web are deposited randomly and do not form an aggregate having an orientation that extends in one dimension over a definite length. As evidence of this fact, applicants are submitting herewith a copy of a publication titled "Spunbond Technology" ("Updated, April, 2004- Atul Dahiya, M. G. Kamath, Raghavendra R. Hegde (Hsu-Yeh Huang and Xiao Gao"). Section 8, "Characteristics and Properties", of the publication describes spunbonded webs as having a random fibrous structure. As further evidence of the fact that fibers in a spunbonded nonwoven web are deposited randomly and do not form an aggregate having an orientation that extends in one dimension over a definite length, submitted with this response are printouts from the websites of Asahi Kasei Fibers Corporation and DuPont which include photographs of spunbonded nonwoven webs. As can be seen from the photographs, the fibers in the spunbonded nonwoven web are distributed randomly and do not form an aggregrate of fibers extending in one dimension over a definite length.

Moreover, the spunbond fibers disclosed in Mirle are not nanofibers. As described in paragraph [0039] of Mirle, which is

referred to in the Action, spunbond fibers "have average between 20 to 30 microns." A range of 20 to 30 microns is equivalent to a range of 20,000 to 30,000 nm. (See also Section 8 of "Spunbond Technology" which describes fiber diameters of spunbonded webs as being from 1 to 50 µm and, preferably, between 15 and 35 µm). Fibers in the aggregate of nanofibers of the present invention have single fiber fineness by number average in a range of 1×10^{-7} to 2×10^{-4} dtex, which is equivalent to a range of 1 to 150 nm (page 12, lines 26-27, of the present specification).

The Office identifies paragraph [0093] of Mirle as describing "[e]xemplary nonwoven webs made from nanofibers (having average fiber diameters from about 10 to 100 nanometers)." (Action, page 3, lines 11-12). However, the nonwoven webs having average fiber diameters from about 10 to 100 nanometers described in paragraph [0093] are described as being available from E-spin Technologies (Chatanooga, Tenn.).

Nanofibers of E-spin Technologies are produced by an electrospinning process. Attached to this response is a document titled "Electrospinning the latest in nanotechnology: chapter 9.2 Manufacturers of Electrospun nanofibers" and a partial English translation thereof. The document describes that E-Spin Technologies, Inc., manufactures nanofibers using electrospinning

processes. As explained in the response filed October 24, 2008, to the first Office Action in this application, nanofibers obtained by electrospinning have a morphology of a two-dimensional aggregate where the nanofibers are disposed without any orientation. (Please refer to page 15, lines 4-6, of the present specification and "Beaded nanofibers formed during electrospinning" (submitted with the response filed October 24, 2009), and especially figures of "Beaded nanofibers formed during electrospinning"). That is, electrospinning is a method of spraying a solution of polymer under an electrical field, such that, although it can provide nanofibers which have small fiber fineness, it cannot provide an aggregate of nanofibers which has the morphology of filament-yarn and/or the morphology of spun yarn and has an orientation that extends in one dimension over a definite length.

For the above reasons, Mirle does not support a case of anticipation of claims 1, 7, 11-12, 16-19, 53 and 58-59 under 35 U.S.C. § 102(b) and removal of the 35 U.S.C. § 102(b) rejection is requested.

Claims 4, 8, 10, 56 and 57 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Mirle. Claims 4, 8, 10, 56 and 57 depend directly or indirectly on claim 1. Claim 1, for the reasons explained above, is patentable over Mirle. Claims 4, 8,

10, 56 and 57, therefore, are prima facie patentable.

Claims 1, 4, 7, 8, 11-12, 16-19, 53 and 56-57 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Benson et al., US 2002/0046656 ("Benson").

Claim 1 and the claims dependent thereon, as explained above, now include the imitations of claim 58. Claim 58 is not included in the rejection over Benson. Therefore, the 35 U.S.C. § 103(a) rejection of claims 1, 4, 7, 8, 11-12, 16-19, 53 and 56-57 over Benson is now moot.

Claims 59 and 59 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Benson in view of Mirle. The Office notes that Benson does not disclose an orientation that extends in one dimension over a definite length or at least several meters. Mirle is apparently cited as teaching that such limitation is known.

Mirle, as explained above, does not disclose an aggregrate of nanofibers extending in one dimension over a definite length. Therefore, the proposed modification of Benson will not result in an aggregrate of nanofibers as recited in claim 1, which includes the limitations of rejected claim 58, or as recited in claim 59.

For the above reasons, the 35 U.S.C. § 103(a) rejection over Benson in view of Mirle is also not proper and should be removed.

A notice of allowability of the application is in order and is

respectfully requested.

The foregoing is believed to be a complete and proper response to the Office Action dated June 11, 2009.

In the event that this paper is not considered to be timely filed, applicants hereby petition for an appropriate extension of time. The fee for any such extension may be charged to our Deposit Account No. 111833.

In the event any additional fees are required, please also charge our Deposit Account No. 111833.

Respectfully submitted,

KUBOVCIK & KUBOVCIK

Ronald J. Kubovcik
Reg. No. 25,401

Atty. Case No. IPE-056
Crystal Gateway 3
Suite 1105
1215 South Clark Street
Arlington, VA 22202
Tel: (703) 412-9494
Fax: (703) 412-9345
RJK/ff

Attachments: -"Spunbond Technology" ("Updated, April, 2004- Atul Dahiya, M. G. Kamath, Raghavendra R. Hegde (Hsu-Yeh Huang and Xiao Gao")
-Printouts from the websites of Asahi Kasei Fibers Corporation and DuPont
-"Electrospinning the latest in nanotechnology: chapter 9.2 Manufacturers of Electrospun nanofibers" and a partial English translation thereof

SPUNBOND TECHNOLOGY

Updated, April, 2004- Atul Dahiya, M. G. Kamath, Raghavendra R. Hegde
(Hsu-Yeh Huang and Xiao Gao)

1. INTRODUCTION

Spunbond fabrics are produced by depositing extruded, spun filaments onto a collecting belt in a uniform random manner followed by bonding the fibers. The fibers are separated during the web laying process by air jets or electrostatic charges. The collecting surface is usually perforated to prevent the air stream from deflecting and carrying the fibers in an uncontrolled manner. Bonding imparts strength and integrity to the web by applying heated rolls or hot needles to partially melt the polymer and fuse the fibers together. Since molecular orientation increases the melting point, fibers that are not highly drawn can be used as thermal binding fibers. Polyethylene or random ethylene-propylene copolymers are used as low melting bonding sites. Spunbond products are employed in carpet backing, geotextiles, and disposable medical/hygiene products. Since the fabric production is combined with fiber production, the process is generally more economical than when using staple fiber to make nonwoven fabrics [1].

2. SPUNBONDING PROCESS

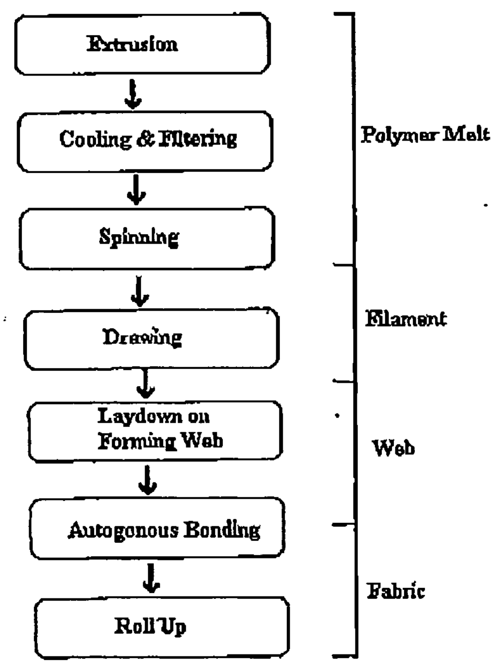


Fig. 1: Flowchart of spunbonding process [3]

3. POLYMER

In general, high molecular weight and broad molecular weight distribution polymers such as PP, PET, Polyamide, etc. can be processed by spunbonding to produce uniform webs. Medium melt-viscosity polymers, commonly used for production of fibers by melt-spinning, are used.

i) Polypropylene

Isotactic polypropylene is the most widely used polymer for spunbond nonwovens production. It

provides the highest yield (fiber per kilogram) and covering power at the lowest cost because of its low density. Considerable advances have been made in the manufacture of polypropylene resins and additives since the first spunbond polypropylene fabrics were commercialized in the 1960s. Although unstabilized polypropylene is rapidly degraded by UV light, improved stabilizers permit several years of outdoor exposure before fiber properties deteriorate. To reduce cost, scrap or polypropylene fibers of inferior quality may be repelletized and then blended in small amounts with fresh polymer to produce first grade spunbond fabrics. This is very advantageous and important in a highly competitive industry.

ii) Polyester

Polyester is used in a number of commercial spunbond products and offers certain advantages over polypropylene, although it is more expensive. Unlike polypropylene, polyester scrap is not readily recycled in spunbond manufacturing. Tensile strength, modulus, and heat stability of polyester fabrics are superior to those of polypropylene fabrics. Polyester fabrics are easily dyed and printed with conventional equipment.

iii) Nylon

Spunbond fabrics are made from both nylon-6, and nylon-6,6. Nylon is highly energy intensive and, therefore, more expensive than polyester or polypropylene. Nylon-6,6 spunbond fabrics are produced with weights as low as 10 g/m2 and with excellent cover and strength. Unlike olefins and polyester fabrics, those made from nylon readily absorb water through hydrogen bonding between the amide group and water molecules.

iv) Polyethylene

The properties of polyethylene fibers that are meltspun by traditional methods are inferior to those of polypropylene fibers. Advances in polyethylene technology may lead to the commercialization of spunbond structures with characteristics not yet attainable with polypropylene. A fiber grade polyethylene was announced in late 1986.

v) Polyurethane

A new type of structure was announced in Japan with the commercialization of spunbond fabrics based on thermoplastic urethanes. Although spunbond urethane fabrics have been previously described, this represents the first commercial production of such fabrics. Unique properties are claimed for this product which appears to be well suited for apparel and other applications requiring stretch and recovery.

vi) Rayons

Many types of rayons have been successfully processed into usable spunbond webs using wet spinning methods. The main advantage of rayon is that it provides good drape properties and softness to web.

4. POLYMER COMBINATIONS

Some fabrics are composed of several polymers. A lower melting polymer can function as the binder which may be a separate fiber interspersed with higher melting fibers, or two polymers may be combined into a single fiber type. In the latter case the so-called bi-component fibers possess a lower melting component, which acts as a sheath covering over a higher melting core. Bicomponent fibers are also spun by extrusion of two adjacent polymers. Polyethylene, nylon-6 and polyesters modified by isophthalic acid are used as bicomponent (lower melting) elements.

5. SPINNING AND WEB FORMATION

Spunbonding combines fiber spinning with web formation by placing the bonding device in line with spinning. In some arrangements the web is bonded in a separate step which, at first glance, appears to be less efficient. However, this arrangement is more flexible if more than one type of bonding is applied to the same web.

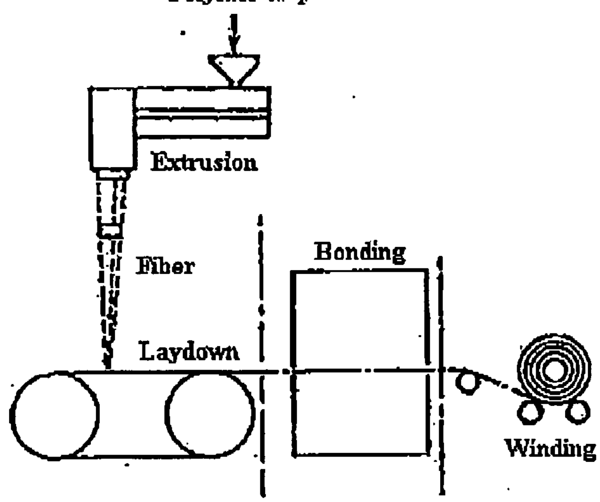


Fig.2: Schematic of spunbonding process

The spinning process is similar to the production of continuous filament yarns and utilizes similar extruder conditions for a given polymer. Fibers are formed as the molten polymer exits the spinnerets and is quenched by cool air. The objective of the process is to produce a wide web and, therefore, many spinnerets are placed side by side to generate sufficient fibers across the total width. The grouping of spinnerets is often called a block or bank. In commercial production two or more blocks are used in tandem in order to increase the coverage of fibers.

Before deposition on a moving belt or screen, the output of a spinneret usually consists of a hundred or more individual filaments which must be attenuated to orient molecular chains within the fibers to increase fiber strength and decrease extensibility. This is accomplished by rapidly stretching the plastic fibers immediately after exiting the spinneret. In practice the fibers are accelerated either mechanically or pneumatically. In most processes the fibers are pneumatically accelerated in multiple filament bundles; however, other arrangements have been described where a linearly aligned row or rows of individual filaments is pneumatically accelerated.

In traditional textile spinning some orientation of fibers is achieved by winding the filaments at a rate of approximately 3,200 m/min to produce partially oriented yarns (POY). The POYs can be mechanically drawn in a separate step for enhancing strength. In spunbond production filament bundles are partially oriented by pneumatic acceleration speeds of 6,000 m/min or higher. Such high speeds result in partial orientation and high rates of web formation, particularly for lightweight structures (17 g/m^2). The formation of wide webs at high speeds is a highly productive operation.

For many applications, partial orientation sufficiently increases strength and decreases extensibility to give a functional fabric (examples: diaper coverstock). However, some applications, such as primary carpet backing, require filaments with very high tensile strength and low degree of extension. For such application, the filaments are drawn over heated rolls with a typical draw ratio of 3.5:1. The filaments are then pneumatically accelerated onto a moving belt or screen. This process is slower, but gives stronger webs.

The web is formed by the pneumatic deposition of the filament bundles onto the moving belt. A pneumatic gun uses high-pressure air to move the filaments through a constricted area of lower pressure, but higher velocity as in a venturi tube. In order for the web to achieve maximum uniformity and cover, individual filaments must be separated before reaching the belt. This is accomplished by inducing an electrostatic charge onto the bundle while under tension and before deposition. The charge may be induced triboelectrically or by applying a high voltage charge. The former is a result of rubbing the filaments against a grounded, conductive surface. The electrostatic charge on the filaments must be at least 30,000 esu/ m^2.

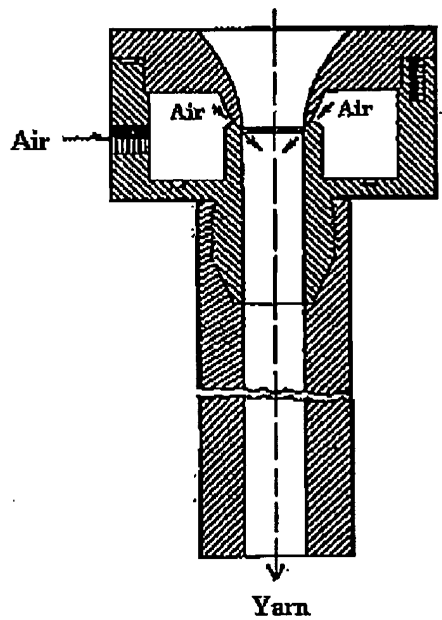


Fig. 4: Pneumatic jet for spunbonding

The belt is usually made of an electrically grounded conductive wire. Upon deposition, the belt discharges the filaments. This method is simple and reliable. Webs produced by spinning linearly arranged filaments through a so-called slot die eliminating the need for such bundle separating devices.

Filaments are also separated by mechanical or aerodynamic forces. The figure below illustrates a method that utilizes a rotating deflector plane to separate the filaments by depositing them in overlapping loops; suction holds the fiber mass in place.

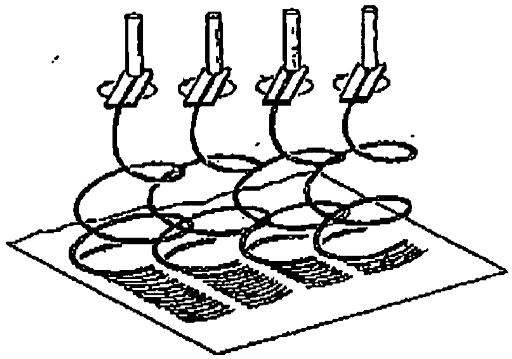


Fig. 5: Deflector plane for separation of filaments

For some applications, the filaments are laid down randomly with respect to the direction of the lay down belt. In order to achieve a particular characteristic in the final fabric, the directionality of the splayed filament is controlled by traversing the filament bundles mechanically or aerodynamically as they move toward the collecting belt. In the aerodynamic method, alternating pulses of air are supplied on either side of the filaments as they emerge from the pneumatic jet.

By proper arrangement of the spinneret blocks and the jets, lay down can be achieved predominantly in the desired direction. The production of a web with predominantly machine direction and cross-machine direction filament lay down is shown in the figure below. Highly ordered cross-lapped patterns can be generated by oscillating filament bundles, as shown.

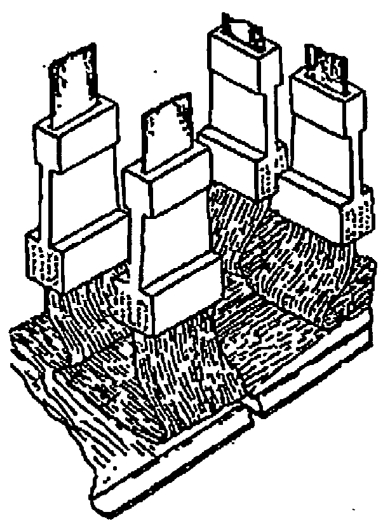


Fig. 5: Web production with machine and cross machine direction

If the lay down belt is moving and filaments are being rapidly traversed across this direction of motion, the filaments are being deposited in a zig-zag or sine-wave pattern on the surface of the moving belt. The effect of the traverse motion on the coverage and uniformity of the web has been treated mathematically. The result is that relationships between the collecting belt speed, period of traverse, and the width of filament curtain being traversed determine the appearance of the formed web. The following illustration shows the lay-down for a process where the collecting belt travels a distance equal to the width of the filament curtain x during one complete period of traverse across a

belt width y. If the belt speed is V_b and the traverse speed is V_t, the number of layers deposited, z, is calculated by $z = [x\ V_t / y\ V_b]$. If the traverse speed is twice the belt speed and if x and y are equal, a double coverage occurs over all areas of the belt.

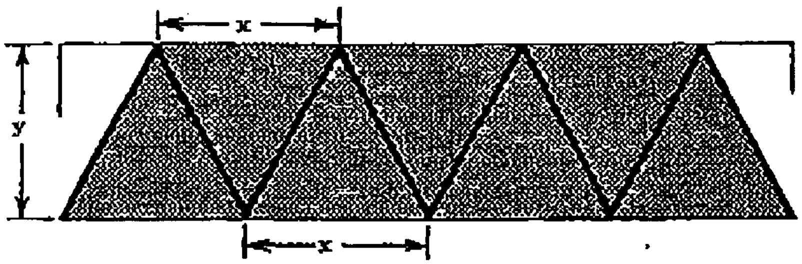


Fig. 6: Web laydown pattern

6. BONDING

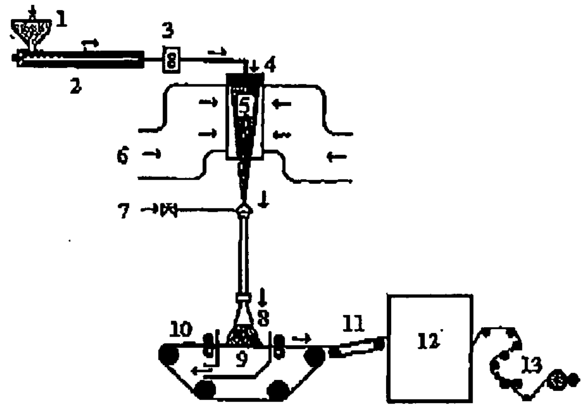
Many methods can be used to bond the fibers in the spun web. Although most procedures were developed for nonwoven staple fibers, they have been successfully adapted for continuous filaments. These include mechanical needling, thermal bonding, and chemical bonding. The last two may bond large regions (area bonding) or small regions (point bonding) of the web by fusion or adhesion of fibers. Point bonding results in the fusion of fibers at points, with fibers between the point bonds remaining relatively free. Other methods used with staple fiber webs, but not routinely with continuous filament webs include stitch bonding, ultrasonic fusing, and hydraulic entanglement. The last method has the potential to produce very different continuous filament structures, but is more complex and expensive. The choice of a particular bonding technique is dictated mainly by the ultimate fabric applications; occasionally a combination of two or more techniques is employed to achieve bonding.

7. SPUNBOND PROCESS SYSTEM

A number of spunbond processes can be fitted into one of these three routes with appropriate modification. The following are three successful spinning, drawing, and deposition systems merit a brief discussion.

7.1 "DOCAN SYSTEM"

This route was first developed by the Lurgi Kohle & Mineral-Oltechnik GmbH of Germany in 1970. Many nonwoven companies have licensed this route from the Lurgi Corporation for commercial production.[3] This route (chart 2 below) is based on the melt spinning technique. The melt is forced by spin pumps through special spinnerets having a large number of holes. By suitable choice of extrusion and spinning conditions, desired filament denier is attained. The blow ducts located below individual spinnerets continuously cool the filaments with conditioned air. The force required for filament drawing and orientation is produced by a special aerodynamic system. Each continuous filament bundle is picked up by a draw-off jet operated on high pressure air and passed through a guide tube to a separator which effects separation and fanning of the filaments [8]. Finally, the filament fan leaving the separators is deposited as a random web on a moving sieve belt. The suction below the sieve belt enhances the random lay down of the filaments.

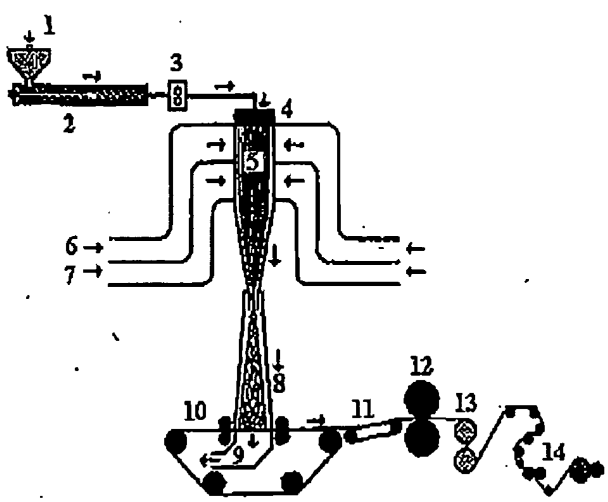


1. Hopper
2. Extruder
3. Spin pump
4. Die block
5. Cooling and stretching chamber
6. Cool air blower
7. Operating air
8. Draw-off and lay down sysytem
9. Suction blower
10. Spin belt
11. Guide belt
12 Chosen bonding
13. Winding unit

Fig. 7: Schematic of Docan spunbonding system

7.2 "REICOFIL" SYSTEM

This route has been developed by Reifenhauser of Germany. Many nonwovens companies have licensed this route from the Reifenhauser GmbH for commercial production. This route (Chart 3 below), is based on the melt spinning technique.[3] The melt is forced by spin pumps through special spinnerets having a large number of holes. The primary blow ducts, located below the spinneret block, continuously cool the filaments with conditioned air. The secondary blow ducts, located below the primary blow ducts, continuously supply the auxiliary room temperature air. Over the line's entire working width, ventilator-generated underpressure sucks filaments and mixed air down from the spinnerets and cooling chambers. The continuous filaments are sucked through a venturi (high velocity, low pressure zone) to a distributing chamber, which affects fanning and entanglement of the filaments. Finally, the entangled filaments are deposited as a random web on a moving sieve belt. The randomness is imparted by the turbulence in the air stream, but there is a small bias in the machine direction due to some directionality imparted by the moving belt. The suction below the sieve belt enhances the random lay down of the filaments.

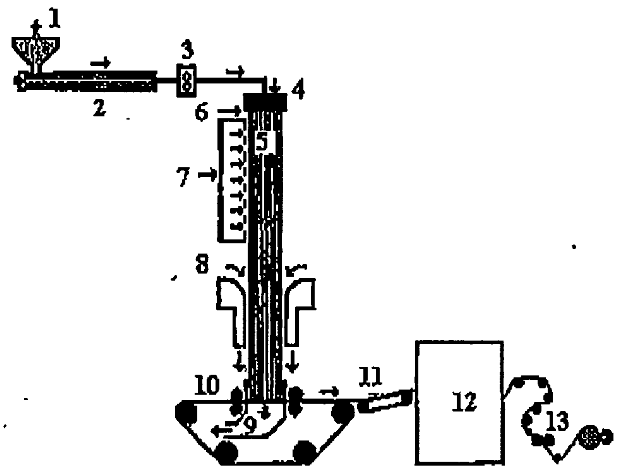


1. Hopper
2. Extruder
3. Spin pump
4. Die block
5. Cooling and stretching chamber
6. Cool air blower
7. Auxilary air blower
8. Filament entangler
9. Suction blower
10. Spin belt
11. Guide belt
12. Thermal calender
13. Chill roll
14. Winding unit

Fig. 8: Schematic of Reicofil spunbonding system

7.3 "LUTRAVIL SYSTEM"

This route was first developed by Carl Freudenberg Company of Germany in 1965. This process is proprietary and is not available for commercial licensing. This route (Chart 4), is based on the melt spinning technique. The melt is forced by spin pumps through special spinnerets having a large number of holes. The primary blow ducts, located below the spinneret block, continuously cool the filaments with conditioned air. The secondary blow ducts, located below the primary blow ducts, continuously supply controlled room-temperature air. The filaments are passed through a special device, where high pressure tertiary air draws and orients the filaments. Finally, the filaments are deposited as a random web on a moving sieve belt [4].



1. Hopper
2. Extruder
3. Spin pump
4. Die block
5. Cooling and Stretching chamber
6. Primary air
7. Secondry air
8. Tertiary air
9. Suction blower
10. Spin belt
11. Guide belt
12. Bonding unit
13. Winding unit

Fig. 9: Schematic of Lutravil spunbonding system

8. CHARACTERISTICS AND PROPERTIES

The spunbonded webs represent a new class of man-made product, with a property combination falling between paper and woven fabric. Spunbonded webs offer a wide range of product characteristics ranging from very light and flexible structure to heavy and stiff structure. [4]

- Random fibrous structure
- Generally the web is white with high opacity per unit area
- Most spunbond webs are layered or shingled structure, the number of layers increases with increasing basis weight
- Basis weights range between 5 and 800 g/m^2, typically 10-200 g/ m^2
- Fiber diameters range between 1 and 50 um, but the preferred range is between 15 and 35 um
- Web thicknesses range between 0. 1 and 4.0 mm, typically 0.2-1.5mm
- High strength-to-weight ratios compared to other nonwoven, woven, and knitted structures

- High tear strength (for area bonded webs only)
- Planar isotropic properties due to random lay-down of the fibers
- Good fray and crease resistance
- High liquid retention capacity due to high void content
- High in-plane shear resistance, and low drapeability.

Spunbond fabrics are characterized by tensile, tear, and burst strengths, elongation-to-break, weight, thickness, porosity and stability to heat and chemicals. These properties reflect fabric composition and structure. Comparison of generic stress-strain curves of thermally bonded and needlepunched fabrics shows that the shape of the load-strain curves is a function of the freedom of the filaments to move when the fabric is placed under stress.

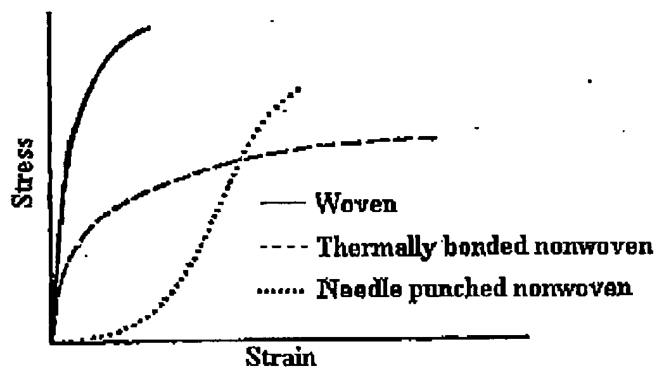


Fig. 9: Typical stress-strain curves

Some applications require special tests for sunlight, oxidation, burning resistance, moisture vapor and liquid transport, coefficient of friction, seam strength and aesthetic properties. Most properties can be determined with standardized test procedures (INDA). Typical physical properties are given below:

Tables 1

Product	Basis wt.	Thickness	Tensile St.[a]	Tear St. N[b]	Mullen	Bonding

	g/m²	mm	N[b]		burst KPa[c]	Method
Accord	69		144MD 175CD	36MD 41CD	324	Point thermal
Bidim	150		495	279	1550	Needlepunch
Cerex	34	0.14	182MD 116CD	40MD 32CD	240	Chemically Induced area
Corovin	75		130	15		Point thermal
Lutradur	84	0.44	275MD 297CD	86MD 90CD	600	Copolymer Area thermal
Polyfelt	137		585	225	1450	Needlepunch
Reemay	68	0.29	225MD 180CD	45MD 50CD	331	Copolymer Area thermal
Terram	137	0.7	850	250	1100	Area thermal [sheath/core]
Trevira	155		630MD	270MD	1520	Needlepunch
Typar	137	0.38	650MD 740CD	345MD 355CD	1210	Undrawn segments-area thermal
Tyvek	54	0.15	4.6MD 5.1CD	4.5MD 4.5CD		Area and point thermal

[a]MD=machine direction; CD=Transverse direction.
[b]To convert N to pound force, divide by 4.448.
[c]To convert Kpa to psi, multiply by 0.145.

9. APPLICATIONS

i) Automotive

Today spunbonded webs are used throughout the automobile and in many different applications. One of the major uses of spunbonded webs in automobile is as a backing for tufted automobile floor carpets. The spunbonded webs are also used for trim parts, trunkliners, interior door panel, and seat covers.

ii) Civil Engineering

The civil engineering market segment remains the largest single market spunbond webs, constituting over 25% of the total. Spunbonded civil engineering webs cover a multiple of related uses, such as, erosion control, revestment protection, railroad beds stabilization, canal and reservoir lining protection, highway and airfield black top cracking prevention, roofing, etc.[6]. The particular properties of spunbonded webs - which are responsible for this revolution - are chemical and physical stability, high strength/cost ratio, and their unique and highly controllable structure which can be engineered to provide desired properties [6].

iii) Sanitary and medical

The use of spunbond web as a coverstock for diapers and incontinence devices has grown dramatically in the past decade. This is mainly because of the unique structure of spunbond, which helps the skin of the user stay dry and comfortable [7]. Additionally, spunbond webs are cost effective over other conventional nonwovens. Spunbond web, as coverstock, is also widely used in sanitary napkins and to a limited extent in tampons.

In medical applications many traditional materials have been replaced by high performance spunbonded webs. The particular properties of spunbonded webs, which are responsible for medical use, are: breathability; resistance to fluid penetration; lint free structure; sterilizability; and,

impermeability to bacteria. Medical applications include: disposable operating room gowns, shoe covers and sterilizable packaging [7].

iv) Packaging

Spunbonded fabrics are widely used as packaging material where paper products and plastic films are not satisfactory. The examples include: metal-core wrap, medical sterile packaging, floppy disk liners, high performance envelopes and stationery products.

REFERENCES

1. Encyclopedia of Polymer Science and Engineering
2. Oldrich Jirsak and Larry C. Wadsworth: 'Nonwoven Textiles', Carolina Academic Press, ISBN: 0-89089-978-8, 1999
3. Sanjiv R. Malkan and Larry C. Wadsworth: 'A review on spunbond technology, Part I', INB, Nonwovens vol.3, 4-14, 1992.
4. Sanjiv R. Malkan and Larry C. Wadsworth: 'A review on spunbond technology, Part II', INB, Nonwovens vol.4, 24-33, 1992.
5. 'Spunbonding ', Textile Month, March, 16, 1999.
6. Poter K.; 'Encyclopedia of chemical technology', 3rd edition, 16, 72-104
7. Smorada, R. L.; 'Encyclopedia of polymer science and engineering', New York, 227-253 NRI, 135, 9, 7-10, 1982.
8. Ian Butler; 'Worldwide prospects for spunbond', nonwovens world, September 59-63, 1999.

Back to Table of Contents

Asahi KASEI ASAHI KASEI FIBERS CORPORATION ▸ SITEMAP

Asahi Kasei Fibers Top Page > Precisé > What is Precisé?

precisé

What is Precisé™?

Site search

Precisé

GO

Precisé Home

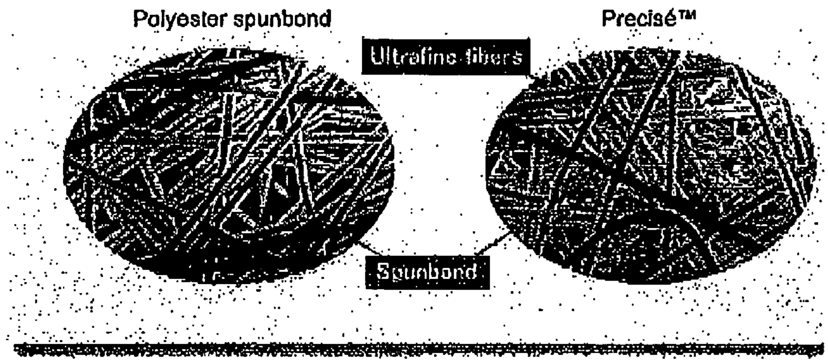
What is Precisé?

Features of Precisé

Applications

Contact us

Precisé™ is a multifunctional nonwoven fabric with high barrier efficiency derivin ultrafine fiber layer.



The name precisé derives from the French word meaning "accurate" and "precis

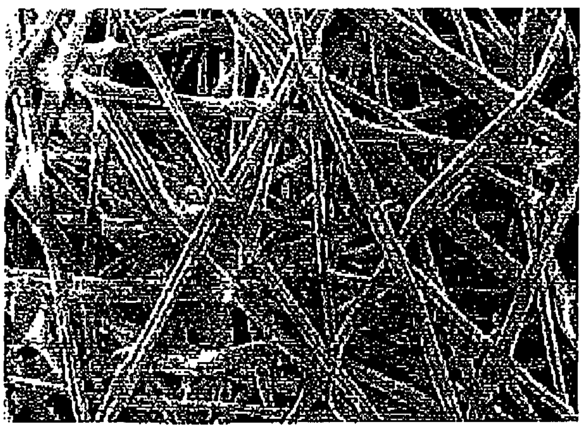
Precisé™ is a trademark of Asahi Kasei Fibers Corporation.

Asahi Kasei Fibers Corporate Profile | Privacy policy | Terms and conditions | Application and Consent | No

DuPont™ Spunbond Polypropylene Filtration Media

THE IDEAL MEDIA FOR MEMBRANE AND CARTRIDGE FILTRATION NEEDS

Nonwoven media composed of thermally bonded continuous polypropylene filaments



DuPont™ Spunbond Polypropylene Filtration Media

- USP Class VI compliance
- CFR 21 part 177.1520 certified
- Bovine Spongiform Encephalopathy (BSE) — free polymer
- Thermally and ultrasonically sealable
- Steam sterilizable

DuPont™ Spunbond Polypropylene Filtration Media

DuPont has been in the science business for over 200 years and we have focused our expertise in delivering a line of polypropylene filtration media to support cartridge and membrane needs. Filtration performance, processability in manufacturing environments and reliable supply are key considerations that impact the success and profitability of your finished filter products. Whether you are creating new filtration products or improving existing ones, the choice of which media to use is an important one. DuPont™ Spunbond Polypropylene Filtration Media is an alternative with cost-effective performance in new and existing applications.

DuPont™ Spunbond Polypropylene Filtration Media is available in high air permeability grades for drain layer and pleat support in both air and liquid applications. It is tear resistant in all directions and has superior tensile strength. The uniform surface offers adherence to membranes compatible with polypropylene. The continuous large filament sheet structure is pleatable with other filtration media, making die cutting and slitting viable.

Consider DuPont™ Spunbond Polypropylene Filtration Media For:

- **Filtration applications requiring membrane support in pharmaceuticals, medical, food and beverage, and microelectronics.**
- **Cartridge and stand-alone filtration needs in chemicals, oil and gas refineries, and paint coating end-use applications.**
- **High air permeability grades for drain layer and pleat support applications in both air and liquid.**
- **Cost-effective performance, in new or existing applications.**

DUPONT

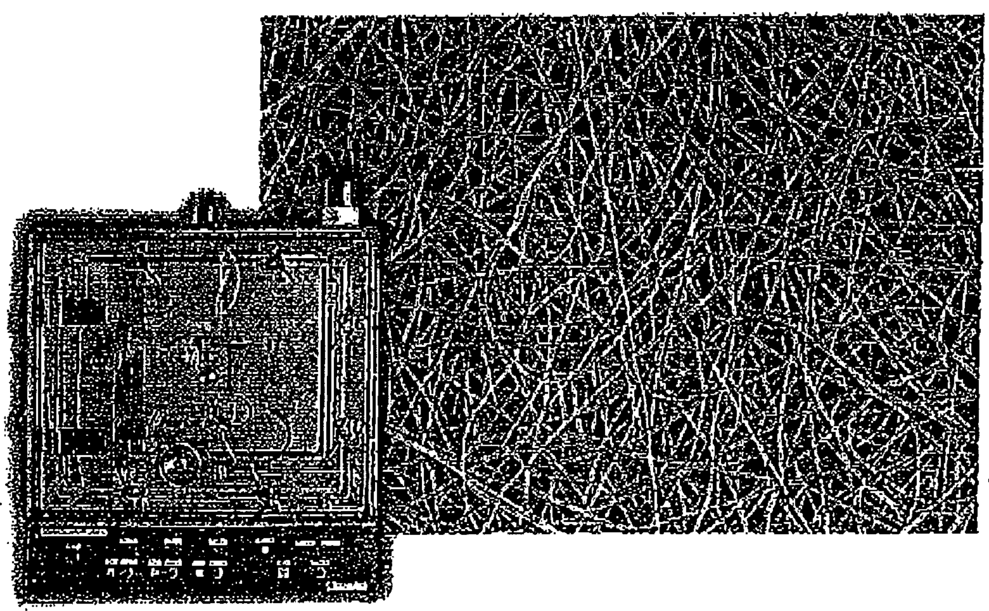
The miracles of science™

ELECTROSPINNING
The Latest in Nanotechnology

エレクトロスピニング最前線

—ナノファイバー創製への挑戦—
The Creative Challenge of Nanofibers

山下 義裕 [著]
Dr. Yoshihiro YAMASHITA



繊維社 企画出版

「バイオ・メディカル」が22件，「電池・セパレーター」が11件，「フィルター」が10件，「特定材料」が12件，その他「分析方法」「繊維配向」「発色」などである．このようにエレクトロスピニング法によるナノファイバーのアプリケーションとしては，バイオ・メディカル，フィルター，セパレーター，電池などの分野において，将来に有用であることがうかがえる．これらの特許の中からいくつかを取り上げたい．

9.2 エレクトロスピニングによるナノファイバー製造企業

現在，エレクトロスピニング法によるナノファイバー製造を行っているのは，ドナルドソン社（アメリカ），フロイデンベルグ社（ドイツ），ファインテック社（アメリカ，韓国），e-Spin 社（アメリカ）日本バイリーン㈱，Elmarco 社（チェコ）などが知られている．

ドナルドソン社はフィルターメーカーで，エレクトロスピニング法によるナノファイバーフィルターを軍事用途に利用しているようである．フロイデンベルグ社は，1980年代からポリカーボネートファイバーを自動車用フィルターに利用している．ファインテック社と e-Spin 社はベンチャー企業で，織物や不織布の表面にナノファイバーをコーティングしている．

エレクトロスピニングに関するアプリケーション特許や製造特許も，ここ数年で飛躍的に報告されるようになった．日本特許に関して，製造装置という観点から興味あるものを紹介する．

9.2 Manufacturers of Electrospun Nanofibers

The currently known nanofibers manufacturers that use electrospinning processes include Donaldson Company Inc. (USA), Freudenberg Vliesstoffe KG (Germany), Finetech, Inc. (USA, Korea), e-Spin Technologies, Inc. (USA), Japan Vilene Co., Ltd. (Japan) and Elmarco s.r.o. (Czech).

Donaldson, a filter manufacturer, is thought to be using electrospun nanofibers to produce military products. Freudenberg have been using polycarbonate fibers as material for automotive filters since the 1980s. Finetech and e-Spin are venture firms manufacturing nanofiber-coated woven and non-woven fabrics.